

## INDIGENOUS TRADITIONAL KNOWLEDGE ON CROP PROTECTION PRACTICES

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### ABSTRACT

*Indigenous knowledge is exclusive to a specific culture of society. This knowledge is the information base for a society and it enables communication and decision making. They are tactics and techniques developed by local people to manage with the changes in the socio-cultural and environmental conditions. As the scenario of agriculture is moving in an organic way, owing to the harassment of chemicals to the environment, human beings and all other living organisms, alternatives for chemical pesticides gains importance, of which indigenous innovative pest control tactics are an inexpensive one, with the rich experiences of ancestors. This contribution reviews the various indigenous crop protection tactics adopted by the local farmers in major food crops in various parts of Tamil Nadu.*

**KEYWORDS:** Indigenous Knowledge, Traditional Crop Protection Tactics, Botanicals, Plant Extracts & Eco- Friendly

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### INTRODUCTION

Our agriculture has sustained for several thousands of years, mainly due to the adoption of eco-friendly agriculture. Until the mid of the twentieth century, agriculture all over the world was based on the principle of eco-friendly, organic farming, which ensured crop and animal food production as well as environmental safety to the human beings and other forms of domestic and non-domestic animals. Since the commencement of green and industrial revolutions, many developing countries abandoned the traditional means of agriculture. The green revolution ushered in with the development of high yielding varieties necessitated many changes in crop production practices, which included increased use of agricultural inputs such as fertilizers, pesticides, water and plant population, which causes depletion of soil layers, nutrient mining, pollution and many other problems.

The total usage of pesticides in India accounts for about 90,000 tonnes annually, of which 63 per cent is used for agriculture. Among, the pesticides used, 70 per cent are insecticides, 12-15 per cent is fungicides and 4-5 per cent are herbicides (Bhardwaj and Sharma, 2013). The indiscriminate use of chemical fertilizers, pesticides and unplanned use of irrigation water have endangered the sustainability of agricultural production. They amplified the health hazards and pollute soil, water and the environment. Also, high yielding varieties invited new pests and the indiscriminate use of pesticides developed resistance and resurgence issues.

Reflecting on excessive, unscientific and imbalanced use of chemical inputs, agricultural scientists, environmentalists and policy makers are now advocating the introduction of low input sustainable agriculture, ecological farming, eco-friendly agriculture and integrated intensive farming system, which is mainly based on the principle of integration of both organic and inorganic farming system so as to acquire the target of agricultural

production without causing severe environmental problems. It is argued that indigenous farming practices offer approaches for sustainable agricultural development.

Indigenous technological knowledge of agriculture is a valuable resource and essential foundation for the development of sustainable agriculture. It is an unwritten body of knowledge, there is no systematic record to describe what it is, what it does, how it does it, means of changing it, its operations, its boundaries and its applications. Indigenous knowledge is a systematic body of knowledge acquired by local people through accretion of experiences, informal experiences and intimate understanding of the environments in a given culture (Thurston, 1992). It is the actual knowledge of a given population that reflects the experiences based on traditions and includes more relevant experiences with modern technologies. Local people, including farmers, landless laborers, women, rural artisans and cattle rearers are the upholders of the indigenous knowledge systems (Singh and Sureja, 2008). Indigenous knowledge is a product of the adaptation of farming practices to the local environment, creating unique indigenous farming practices. One of the most important features of traditional farming systems is their high degree of biodiversity (Altieri, 2003), which will also contribute in preventing the erosion of genetic resources.

Indigenous knowledge of the rural people is dynamic and unique to given culture and society. It changes through indigenous creativity and innovativeness as well as through contact with knowledge system. Moreover, an indigenous traditional farming system provides a lifestyle that binds a household together and subsequently leads to passing of family heritages to future generation's through inheritance of the farm (Edward, 1993). At present these passes from generation to generation orally and in the wake of intensive interventions are likely to be lost as the people become old and leave this world (Berkes *et al.*, 2000). In recent years a growing number of scientists and organizations are recognizing that it offers cheap locally adopted solutions to development problems, or that it can be molded with scientific knowledge to boost productivity and living standards. The body of knowledge, science and techniques used by rural people if well documented can make an important contribution to the agricultural society.

## INDIGENOUS PLANT PROTECTION KNOWLEDGE

In the light of various farm practices adopted traditionally, it is of interest to focus on various crop protection techniques which are mostly produced and perpetuated traditionally. Indigenous knowledge was shown in protecting the seeds and other planting materials free of pests in storage as well as in field conditions. Seed selection, storage and protection of food grains using traditional containers were adopted. In all the measures of pest control the most widely used pesticidal plants include neem, tobacco etc. (Table 1).

**Table 1: List of Plants with Pesticidal Action**

S. No.	Common Name	Scientific Name	Pests Managed	Plant Part Used	Mechanism of Action
1	Neem	<i>Azadirachta indica</i>	Sucking pest, defoliators and stored grain pests	Leaf, twig, bark, seed, kernel	Contact, stomach poison, oviposition deterrent, repellent, metabolic disruptor and toxicant
2	Tobacco	<i>Nicotiana glauca</i>	Defoliators	Leaf and stem	Stomach poison and repellent
3	Pungam	<i>Pongamia pinnata</i>	Sucking pest and defoliators	Leaf and seeds	Antifeedant and repellent

Table 1: Contd.,

4	Calotropis	<i>Calotropis gigantea</i>		Leaf and twig	Stomach poison and growth inhibitor
5	Acorus	<i>Acorus calamus</i>	Stored grain pests	Rhizome	Antifeedant, anti repellent and toxicant
6	Custard apple	<i>Annona squamosa</i>	Stored grain pests	Leaf, twig, seeds	Antifeedant and anti repellent
7	Indian Privet	<i>Vitex negundo</i>	Stored grain pests	Leaf, twig, seeds	Contact poison and growth inhibitor
8	Adathoda	<i>Justica adhatoda</i>	Leaf scrappers	Leaf	Antifeedant
9	Garlic	<i>Allium sativum</i>	Defoliators and sucking pests	Pods	Repellent, antifeedant and toxicant
10.	Nerium	<i>Nerium oleander</i>	Defoliators	Leaf and stem	Repellent, antifeedant and toxicant
11	Common Tansy	<i>Tanacetum vulgare</i>	Defoliators	Flowers	Feeding deterrent
12	Wild marygold	<i>Tagetes minuta</i>	Defoliators	Flower	Repellent and toxicant
13	Black pepper	<i>Piper nigrum</i>	Defoliators	Leaf	Toxicant, oviposition deterrent
14	Chilli	<i>Capsicum annum</i>	Pulsebeetle	Fruit powder	Insecticide
15	Babool	<i>Acacia nilotica</i>	Stemborer and leaf feeders	Crushed powder from leaves seed and bark	Antifeedant
16	Panivaragyu	<i>Paspalum scrobiculatum</i>	Leaf hoppers in rice	Plant	Detterent

The indigenously used plant materials are safe, bio-degradable, less persistent, non-toxic and easily available in and around their house tenements and land. Thus, over the years has led to adoption of crop production techniques of their choice and ability thus producing crops at specific seasons required for their livelihood.

Some of the common traditional practices followed by local farmers generation to generation are listed below:

## ECO FRIENDLY AGRICULTURAL PRACTICES ADOPTED FOR CROP PROTECTION

### Paddy

- Trimming the field bunds to control weeds, pests, diseases and rats.
- Integrating other allied enterprises like poultry and fish. Droppings from poultry is used as manure for crops and feed for fish.
- Clipping the tip of paddy seedlings to eliminate stem borer, *Scirpophaga incertulas* egg masses before transplanting.
- Immersing paddy seeds in concentrated common salt solution make coffee and diseased seeds to float, which can be removed and the seeds settled at the bottom are used for sowing.
- Application of 100 kg of pig manure at 10 days after planting for one acre of rice crop gives higher yield.
- Application of eruku (*Calotrophis gigantea*) as green leaf manure prevents thrips attack in the rice nursery field.
- Application of cassia (*Cassia auriculata*) to control insect incidence as well as green leaf manure.
- Application of notchi (*Vitex negundo*) as green leaf manure and to control insect pests.

- Using “Panchakaviam” (FYM solution + cow’s urine + milk + curd + ghee) for control of pests and diseases. It also acts as a growth inducer.
- Raising and ploughing green manure crops like daincha (*Sesbania sp.*), wild indigo (*Tephrosia purpurea*) in the field at the time of flowering to reduce weed population.
- Neem cake applied @ 6.25 t/ha as basal manure helps to protect the crop from the brown plant hopper (*Nilaparvatha lugens*).
- Cultivation of sunnhemp (*Crotalaria juncea*) or daincha (*Sesbania sp.*) helps to control nut grass weed at summer.
- Mixture of neem oil and pungam (*Pongamia glabra*) oil at 1:1 ratio is sprayed to control leaf folder.
- Neem cake is dissolved in irrigation water to control stem borer, BPH and leaf folder.
- Birds like ducks, sparrows etc. can be terrified by tying of palmyrah (*Borassus flabellifer*) fronds on to poles on the corners of rice field, so that the noise produced by them due to wind scare them away and save the grains being damaged.
- Spraying of neem oil mixed with water@30 ml/lit to control stem borer in rice.
- Dissolve neem cake in irrigation water to control brown plant hopper and green leaf hopper.
- Early morning dusting of ash controls stem borer.
- Cow’s urine, neem oil and tobacco decoction were mixed and sprayed to control sucking pest infestation.
- Spraying tobacco (*Nicotiana tabacum*) leaf extract (5%) to control BPH and green leaf hopper.
- Application of neem cake, as basal manure in rice fields helps to protect the crop against BPH and stem borer at later stages.
- Cow dung, cow’s urine and jaggery solution, @ 1-10 % concentration, that acts a growth promoter and facilitates N fixation.
- Spraying the mixture of coconut milk and butter milk sprayed at 10 % concentration, acts as growth regulator, pest repellent, resistance to fungal disease and induce flowering.
- Placing leaves of notch ( *Vitex negundo*) and pungam (*Pongamia glabra*), inside the mudpots ward off storage pests.
- While storing the paddy in a room, the floor is coated with cow dung solution to avoid pest attack.
- Placing neem leaves inside the paddy bags, or keeping them between the bags, repels storage pests.
- Paddy seeds (after harvest) are sun dried for two days and shade dried for one day before storing, to prevent the attack of storage pests.
- A traditional storage device called “patayam” was used traditionally to store rice grains to avoid pest attack (Devanand and Kanagasabapathy, 2002).
- Storing paddy grains in large mud pots as high as six feet called ‘Kudhir’, for long storage.

- Custard apple (*Annona squamosa*) leaf extract is used to repel brown plant hopper.
- Placing custard apple leaves inside paddy bags repels storage pest, *Sitophilus oryzae*.
- Broadcasting leaves of *Calotropis* in paddy field, to check the movement and infestation of lepidopteron larvae.
- Application of sheep/goat/pig manure will lessen the incidence of pests and diseases.
- Sun drying for two days and shade drying once before storing the rice grains prevent the attack of storage pests.
- Paddy seeds mixed with *Ipomea* leaves act as pest repellent.
- To reduce rat population, rat holes are dug and rats are killed after each harvest.
- Placing fresh cow dung on both fields and bunds reduce rat problems.
- Placing 'effigies' with white dress made of straw in the centre of the field to scare away the birds.
- Placing 'owl staries' on the main field at different places to control rats.
- Burning cycle tyre to repel pests.
- Adathoda leaf extract + cow dung slurry repels larva of rice leaf folder (Kanagasabapathy, 1996).

### Cotton

- Cotton seeds are mixed with wet cow dung and dried for 30 minutes after which they are slightly rubbed against a stone and cleaned for delinting.
- Red soil coating of cotton seeds with red soil and sun drying before sowing to ensure good germination and easy dibbling.
- Nipping is done at 60-70 days after sowing to arrest terminal growth and to have more branches.
- Soaking white piece of cloth in turmeric solution, dried, again soaked in castor oil and tied in the fields in different locations under which chimney lamps are kept to control sucking pests like white flies.
- Raising castor as trap crop to minimize pests attacking the main crop.
- Cultivating intercrops like cow pea, greengram and black gram reduces the population of sucking pests like aphids, leaf hoppers and boll worms.
- Using light traps to monitor and kill the attracted adult moths of all lepidopteran pests.
- Basal application of FYM 25 t/ha with neem cake is done to control stem weevil.
- Spraying of sugar extract solution mixed with water to control mealy bugs.
- About 600 g of tobacco is soaked in water for 2-3 days, filtered and sprayed to control whiteflies (Devanand and Kanagasabapathy, 2002).

### Sugarcane

- Sugarcane trashes are burnt before the next ratoon crop, for killing insects and pathogens.

- Topping and breaking the ridges with spade after the harvest of canes before allowing for ratoon, for better root growth and soil aeration.
- Selecting setts, with shorter internodes for planting to maintain optimum plant density.
- Practicing sheep penning and application of sheep manure (6.25 t/ha) enables to increase the sugar content of the canes.
- Growing castor as border crop to control early shoot borer attack in sugarcane.
- Practising earthing up in sugarcane, at 50 days after planting to control early shoot borer.
- Detrashing (locally called “sogaiuriththal”) the canes to control scales and mealy bugs

### Groundnut

- Soaking groundnut seeds in lime solution to minimize insect attack and for better germination.
- Splash method of irrigation to reduce water loss.
- Setting up light traps and bonfires immediately after receipt of rains, after sowing in the rainfed season, to attract and kill moths of red hairy caterpillar.
- *Calotropis* leaves are placed near groundnut field to reduce insect attack.
- Groundnut kernels stored with shells have longer life even for more than six months.
- Empty iron drums are beaten in groundnut field to ward off the birds which may eat and destroy the pods.
- Groundnut leaf miner and thrips can be managed, by spraying *Vitex negundo* leaf extract.

### Vegetables

- A tribal treatment consisting of *Calotrophis* leaf+garlic+onion+chilli powder was found to be effective against brinjal, *Epilachna* beetle, pumpkin caterpillar and tomato fruit borer infestations (Narayanasamy, 2006).
- *Jathropa* and *Calotrophis* leaf extract controls shoot and fruit borer of brinjal and whiteflies.
- *Vitex* leaf extract was found to control bhendi white flies, *Bemisia tabaci*.
- Sweet flag, *Acorus calamus* leaf and rhizome extract was found to manage grasshoppers.
- Mixture of fenugreek, betelvine, onion, buttermilk and castor oil showed its efficacy against the larva of *Spodoptera litura*, a polyphagous pest of vegetables, pulses, millets and oilseeds.
- *Calotrophis* leaf extract excelled in curbing tapioca white fly infestation.
- *Lantana camara* leaf and flower extract manages two spotted mites, *Tetranychus urticae* of vegetables.

### Storage Pests

Bio pesticides are highly used to tackle major stored grain pests like rice moth, red flour beetle, pulse beetle and rice weevil.

- Mixing seeds with neem leaf extract 5% before sowing pulse seeds.
- Spraying neem seed kernel extract twice to control pod borer at flowering and fruiting stage.
- Spraying tobacco decoction from tobacco waste to control sucking pests and caterpillars.
- *Aloe vera* (kathalai) leaves of *Bougainvillea* and papaya were boiled and added with turmeric powder and sprayed at a concentration of 10% to control fungal diseases and insect pests.
- Purified buttermilk is sprayed on cowpea crop to control yellow mosaic disease.
- Neem leaf powder 2% is used to keep pests away from greengram storage.
- Harvested greengram is mixed with ash 2% and dried to control storage pests.
- Pulse seeds are stored with *Ocimum sanctum* seeds for controlling stored pests.
- *Vitex negundo* leaves are incorporated in pulses before storage.
- Mixing red gram seeds with red earth slurry, allowed to dry and stored to avoid storage pests.
- Neem oil or groundnut oil is mixed with redgram seeds before storing them.
- Cow pea pods are sun dried until they become brittle to avoid storage pests.
- Vegetable oil (2 ml/kg of seeds) is mixed with cowpea before storage to avoid pulse beetles.
- Application of neem cake @ 150 kg/ha basally, to reduce root rot and also to have nematostatic action against cyst nematode.
- Pulses are stored in salted gunny bags to resist storage pests.
- Sundried redgram mixed with a paste of laterite soil is used to keep the pests away for one year.
- Powdered seeds of *Annona squamosa* is used repel storage pests like pulse beetle.
- Mixture of kitchen ash, chilli powder and lime is used to repel pests in storage godowns.
- Dusting turmeric powder repels pulse beetle.
- Application of kitchen ash, mixture of chilli powder, lime + ash and *Clerodendron* leaf extract, repels pest in godown condition (Kathirvelu and Narayanasamy, 2005).

## CONCLUSION

There is an abundant traditional knowledge and practices of plant protection among rural farmers, which need to be tapped for present and future agriculture. Indigenous methodologies are excellent alternatives to chemical pesticides in conjugation with components like botanicals, bio-pesticides, resistant varieties, pheromones etc. Elements of plant and animal origin need to be concentrated more for effective pest control to overcome the side effects of chemical pesticides. It is therefore suggested that extension agencies should intensify their efforts to organize extension educational programs like trainings, demonstrations, field days, etc., to motivate the farmers to accept and adopt the traditional indigenous plant protection practices, which are safer to the environment. The eco-friendly nature of indigenous practices as against

synthetic pesticides should be emphasized. In the extension programs, a special importance should be given to promote traditional, environmentally safe pest management by conducting skilled demonstrations and specialized participatory trainings. As the world is moving towards “Go green” slogan, encouraging and educating the farming community to adopt eco-friendly pest management strategies to pause environment being polluted by synthetic insecticides is a need of the hour to mend Indian farming.

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